

REMARKS

Applicant submits this Amendment "F" and Request for Continued Examination for the Examiner's consideration. Reconsideration of the application, as amended, in view of the following remarks is respectfully requested.

1. STATUS OF THE CLAIMS

Claims 1-28 and 36-63 were presented for examination and they stand rejected and pending in the application. These rejections are addressed below.

2. RESPONSE TO REJECTIONS

2.1. Claim Objections

Claims 5 and 46 have been amended to correct the unintended typographic errors as noted in the Office Action.

To remove issues from prosecution, claim 46 has been amended to replace the form of the indefinite article "a" for the form "an" as required in the Office Action. Applicant notes, however, that the use of the appropriate form of the indefinite article that is objected to in the Office Action is acceptably adopted with reference to the phonetics of the initial letter in the word that follows such article rather than according to the actual form of such initial letter.

Applicant submits that the grounds for the objections asserted in the Office Action have been removed, and reconsideration and withdrawal of these objections are respectfully requested.

2.2. Claim Rejections Under 35 U.S.C. § 112 ¶ 2

Claim 11 is rejected in the Office Action under 35 U.S.C. § 112 ¶ 2. This claim has been amended as required to complete the unintendedly omitted claim language. Support for this

amendment is found in the application as filed and in the language of other pending claims. *See, e.g.,* other claims reciting the use of a furnace.

Applicant submits that the pending claims comply with 35 U.S.C. § 112 ¶ 2, and reconsideration and withdrawal of this rejection is respectfully requested.

2.3. Claim Rejections Under 35 U.S.C. § 103(a)

Rejections under 35 U.S.C. § 103(a) are asserted in the Office Action over Dixit, *et al.*, U.S. Pat. No. 6,333,265 (hereinafter "Dixit") in view of Xu, *et al.*, U.S. Pat. No. 6,217,721, or over Dixit and Xu in combination with Taguchi, U.S. pat. No. 6,306,761 (hereinafter "Taguchi").

Applicant addresses hereinbelow these rejections.

The Office Action asserts that Dixit teaches "forming an energy absorbing layer (column 8, lines 43-47) on said aluminum layer (50)". Office Action, p. 3. Applicant respectfully submits that Dixit does not teach or suggest this formation and that it does not teach or suggest the recited limitations regarding an energy absorbing layer.

Dixit discloses that "[a] cap layer (not shown) of a PVD aluminum alloy such as one or more of ..., can optionally be applied to a thickness of about 500-5000 Å to facilitate doping of the CVD aluminum layer." Dixit, col. 8, ll. 43-48. This teaching of the formation, which is indeed simply optional, of a layer for facilitating doping of a CVD aluminum layer fails to disclose or suggest the formation of an energy absorbing layer to which energy will be applied as presently recited with the limitations of each pending claim.

Dixit also fails to disclose or suggest the formation of a seed layer and the additional features as indicated in the Office Action.

Xu fails to disclose or suggest the formation of an energy absorbing layer as presently recited with the limitations of each pending claim. Applicant notes that the disclosure in Xu of an anti-

reflection coating "ARC layer 338 [that] is deposited over the upper metal layer 334 to facilitate photolithographic delineation into interconnects" (Xu, col. 26, ll. 16-19; Fig. 17) does not disclose or suggest the formation of an energy absorbing layer as presently recited with the limitations of each pending claim.

Furthermore, Xu fails to disclose the formation of a seed layer with the features and limitations recited in the pending claims. In particular, Xu fails to disclose the relationships amongst the melting points of the various layers as recited in the pending claims. For example, claim 1 recites, *inter alia*, "the diffusion barrier being composed of a material having a melting point greater than or equal to that of a material from which the seed layer is composed". The Office Action associates layer 164 in Xu with a seed layer. Office Action, p. 4. Even if, *arguendo*, this association could be made, Applicant notes that titanium nitride layer 162 has a higher melting point than titanium layer 160,¹ and thus the relationships amongst the different melting points as recited in the pending claims are not satisfied by the layers disclosed in Xu.

It has not been established that Taguchi provides any basis that would overcome the limitations and differences established with respect to the disclosure in Dixit and/or Xu.

"To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation ... to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations." Furthermore, the "teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." (citations omitted)

¹ Melting point of titanium = $1660^{\circ}\text{C} \pm 10^{\circ}\text{C}$; melting point of titanium nitride = 2930°C . Physical Constants of Inorganic Compounds, CRC Handbook of Chemistry and Physics, p. B-140, 68th ed.

M.P.E.P. §§ 2142, 2143, pp. 2100-121, -122 (8th ed., Aug. 2001). For at least the reasons set forth above, Applicant respectfully submits that these criteria are not satisfied by Dixit and/or the other cited references, even if such references were combinable.

Because of differences and limitations such as those described hereinabove, the cited references have not suggested the claimed subject matter, and it may not be asserted that the teachings provided by such references are sufficient for one of ordinary skill in the art to make the substitutions, combinations or other modifications that are necessary to arrive to the claimed invention.

Consequently, Applicant respectfully submits that Dixit and the other cited references do not support a *prima facie* case of obviousness regarding the pending claims. Applicant respectfully requests the reconsideration and withdrawal of this rejection.

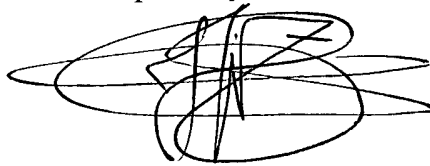
3. CONCLUSIONS

In view of the above, Applicant respectfully maintains that the present application is in condition for allowance. Reconsideration of the rejections is requested. Allowance of the pending claims at an early date is solicited.

In the event that the Examiner finds any remaining impediment to a prompt allowance of this application which could be clarified by a telephonic interview, or which is susceptible to being overcome by means of an Examiner's Amendment, the Examiner is respectfully requested to initiate the same with the undersigned attorney.

Dated this 11th day of July 2002.

Respectfully submitted,

A handwritten signature in black ink, appearing to be 'Jesús Juanós i Timoneda', written over a series of horizontal lines.

Jesús Juanós i Timoneda, Ph.D.
Attorney for Applicant(s)
Registration No. 43,332

WORKMAN, NYDEGGER & SEELEY
1000 Eagle Gate Tower
60 East South Temple
Salt Lake City, Utah 84111
Telephone: (801) 533-9800
Facsimile: (801) 328-1707

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Marked up Version of the Pending Claims Under 37 C.F.R. § 1.121(c)(1)(ii):

5. (Twice Amended) A method for manufacturing an interconnect structure as recited in Claim 1, further comprising, prior to forming a seed layer on the diffusion barrier layer, heating the diffusion barrier layer i[s]n an environment substantially containing a nitrogen gas.

11. (Thrice Amended) A method for manufacturing an interconnect structure as recited in Claim 1, wherein applying energy to said energy absorbing layer utilizes a furnace.

46. (Twice Amended) A method for manufacturing an interconnect structure, the method comprising:

forming a dielectric material over a semiconductor substrate and having a top surface;

forming a recess within the dielectric material extending from the top surface of the dielectric material to the semiconductor substrate;

filling the recess with an electrically conductive material, the recess including:

a first portion having an uniform width and extending within the dielectric material to the top surface of the dielectric material;

a second portion having a height and a uniform width that is less than the width of the first portion and that is not greater [then] than 25% of the height, the second portion extending from the semiconductor substrate to terminate at the first portion;

wherein the filling the recess is performed by causing the electrically conductive material to flow within the recess by applying omnidirectional heating.

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